

## CLAIMS

What is claimed is:

1. A query system for structured multimedia content retrieval, said system including:

5 a query language having query constructs and formalisms for specifying characteristics of extensible markup language (XML) documents for retrieval; and  
wherein said characteristics include spatial, temporal, and visual datatypes.

2. A query system as recited in claim 1, wherein said query language includes:  
means for resolving intensional data and relationships arising from any of:

- (a) XML datatype mechanism;
- (b) irregular XML structures; and
- 5 (c) co-occurrence constraints.

3. A query system as recited in claim 2, wherein said means for resolving comprises a logic formalism for supporting queries on XML documents with any of:

- (A) intensional data and relationships;
- (B) irregular document structures; and
- 5 (C) and co-occurrence constraints.

4. A query system as recited in claim 1, wherein said query language includes  
means for identifying specification issues in XML query language for XML document retrieval.

5. A query system as recited in claim 1, wherein said query language includes  
means for identifying specification issues in XML query language for MPEG-7 document retrieval.
6. A query system for structured multimedia content retrieval, said system including:  
a query language based on logic formalism for content retrieval; and  
said logic formalism including atomic logic formulas, said atomic logic formulas being element predicates in a relational calculus.
7. A query system as recited in claim 6, wherein said query language comprises query constructs and formalisms for specifying different aspects of extensible markup language (XML) documents.
8. A query system as recited in claim 7, wherein said query constructs and formalisms are adapted for spatial, temporal and visual datatypes.
9. A query system as recited in claim 7, wherein said query constructs and formalisms are adapted for spatial, temporal and visual datatypes in MPEG-7 documents.
10. A query system as recited in claim 6, wherein:  
queries in said relational calculus are equivalent to a proof-finding process; and  
said proof-finding process comprises finding all proofs to existential closure of logical assertions in the form of path predicates required to be satisfied by tree document elements.
11. A query system as recited in claim 7, wherein spatial, temporal and visual datatypes and relationships are described in said logic formalism for content retrieval.

12. A query system as recited in claim 7, wherein said query language includes:

means for resolving intensional data and relationships arising from any of:

- (a) XML datatype mechanism;
- (b) irregular XML structures; and
- (c) co-occurrence constraints.

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13. A query system as recited in claim 12, wherein said query language includes

means for identifying specification issues in XML query language for XML document retrieval.

14. A query system as recited in claim 13, wherein said query language includes

means for identifying specification issues in XML query language for MPEG-7 document retrieval.

15. A query system for structured multimedia content retrieval, said system including:

a query language based on logic formalism for content retrieval; and

said logic formalism including atomic logic formulas, said atomic logic formulas being element predicates in a relational calculus.

16. A query system as recited in claim 15, wherein:

queries in said relational calculus are equivalent to a proof-finding process; and

said proof-finding process comprises finding all proofs to existential closure of logical assertions in the form of path predicates required to be satisfied by tree document elements.

17. A query system as recited in claim 15, wherein spatial, temporal and visual datatypes and relationships are described in said logic formalism for content retrieval.

18. A query system as recited in claim 15, wherein said query language includes:  
means for resolving intensional data and relationships arising from any of:

- (a) XML datatype mechanism;
- (b) irregular XML structures; and
- (c) co-occurrence constraints.

19. A query system as recited in claim 18, wherein said query language includes  
means for identifying specification issues in XML query language for XML document retrieval.

20. A query system as recited in claim 19, wherein said query language includes  
means for identifying specification issues in XML query language for MPEG-7 document retrieval.

21. A query system for structured multimedia content retrieval, said system including:  
a query language based on logic formalism for content retrieval;  
said logic formalism including atomic logic formulas, said atomic logic formulas being element predicates in a relational calculus;

means for identifying given specifications of multimedia XML documents in MPEG-7 XML query specifications; and

means for applying said logic formalism for processing said given specifications for specifying spatial and temporal relationships pertaining to said XML documents to support MPEG-7 XML document retrieval and modification of multimedia XML documents.

22. A query system in accordance with claim 21, wherein said given specifications include intensional data and relationships specifications, document addressing specifications, and co-occurrence constraints specifications.

23. A query system in accordance with claim 21, wherein said given specifications include element datatypes.

24. A query system in accordance with claim 23, wherein spatial and temporal relationships are derived from said element datatypes.

25. A query system in accordance with claim 24, wherein spatial and temporal relationships are further included in said given specifications as a complex datatype for multimedia XML documents.

26. A query system in accordance with claim 23, wherein said datatypes include:

(A) Mpeg7Type, basic datatypes, reference datatypes, unique identifier datatypes, and time datatypes;

5 (B) MPEG-7 visual datatypes used to specify visual properties of multimedia objects, including spatial, color, texture, motion, location; and

(C) MPEG-7 audio datatypes are used to specify audio content.

27. A query system in accordance with claim 21, including a tool for generating a description from a video based on a scene change technique, said tool including processing means for:

(a) breaking down the video temporally into scenes or shots using scene change detection algorithms that can detect both abrupt as well as gradual changes;

5 (b) outlining user-identified objects of interest within said scenes;

(c) tracking said user-identified objects;

(d) creating a node point where a significant motion change wherein a linear mode is inadequate;

10 (e) providing the specification of said user-identified objects as any of temporal, audio, and visual datatypes; and

(f) providing a description of said user-defined objects as any of spatial, temporal and visual datatypes.

28. A query system in accordance with claim 27, wherein processing means provides said tracking said user-identified objects in a semi-automatic manner.

29. A query system in accordance with claim 27, wherein processing means provides said description of said user-defined objects said by the use of abstract datatype techniques (ADT).

30. A query system in accordance with claim 27, wherein processing means provides said respective datatypes as composite datatypes constructed from more primitive ones.

31. A query system for multimedia content retrieval, said system including:

a query language based on logic formalism for content retrieval, said logic formalism being hereinafter referred to as Path Predicate Calculus and being utilized for logic-based queries and manipulations;

5           said Path Predicate Calculus including atomic logic formulas, said atomic logic formulas being element predicates in a relational calculus and comprising element predicates and path predicates, for asserting logical truth statements about document elements in a document tree;

          means for identifying given specifications of multimedia XML documents in MPEG-7 XML query specifications; and

10           means for applying said logic formalism for processing said given specifications for specifying spatial and temporal relationships pertaining to said XML documents to support MPEG-7 XML document retrieval and modification. multimedia XML documents.

32.    A query system as recited in claim 31, wherein:

          queries in said relational calculus are equivalent to a proof-finding process; and

          said proof-finding process comprises finding all proofs to existential closure of logical assertions in the form of path predicates required to be satisfied by tree document elements.

33.    A query system as recited in claim 31, wherein spatial, temporal and visual datatypes and relationships are described in said logic formalism for content retrieval.

34.    A query system as recited in claim 31, wherein said query language includes:

          means for resolving intensional data and relationships arising from any of:

          (a) XML datatype mechanism;

          (b) irregular XML structures; and

5           (c) co-occurrence constraints.

35. A query system as recited in claim 34, wherein said query language includes means for identifying specification issues in XML query language for XML document retrieval.

36. A query system for structured multimedia content retrieval, said system including:  
a query language based on logic formalism for content retrieval, said language including query constructs and formalisms for specifying different aspects of XML documents; and  
wherein said constructs and formalisms are particularly adapted for spatial, temporal and  
5 visual datatypes.

37. A query system as recited in claim 36, wherein said query language identifies intensional data and relationships due to XML datatype mechanisms, irregular XML structures, and co-occurrence constraints for document retrieval.

38. A query system as recited in claim 37, wherein said query language is specially adapted for MPEG-7 documents.

39. A method for structured multimedia content retrieval, said method comprising:  
utilizing a query language based on logic formalism for content retrieval, said logic formalism including atomic logic formulas, said atomic logic formulas being element predicates in a relational calculus;

5 identifying given specifications of multimedia XML documents in MPEG-7 XML query specifications; and

applying said logic formalism for processing said given specifications for specifying spatial and temporal relationships pertaining to said XML documents to support MPEG-7 XML document retrieval and modification of multimedia XML documents.



40. A method as recited in claim 39, comprising:

generating a description from a video based on a scene change technique, said generating including the steps of:

(a) breaking down the video temporally into scenes or shots using scene change

5 detection algorithms that can detect both abrupt as well as gradual changes;

(b) outlining user-identified objects of interest within said scenes;

(c) tracking said user-identified objects;

(d) creating a node point where a significant motion change wherein a linear mode is inadequate;

10 (e) providing the specification of said user-identified objects as any of temporal, audio, and visual datatypes; and

(f) providing a description of said user-defined objects as any of spatial, temporal and visual datatypes.